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(54) IMAGE PROCESSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an image processor capable of automatically performing natural gradation correction and correcting saturation/sharpness by simple processing.

SOLUTION: Relation between a luminance signal and appearance frequency is obtained from a cumulative histogram of the luminance signal in an inputted video signal. At least one of a 1st correction parameter (Da) for correcting the luminance signal in a shadow area which is a 1st threshold (A) or less and a 2nd correction parameter (Db) for correcting the luminance signal in a highlight area which is a 2nd threshold (B) or more is found out in the obtained relation. A suitable gradation pattern is selected from previously determined gradation patterns and the inputted video signal is corrected on the basis of the selected gradation pattern. Consequently the video signal can be corrected so as to obtain an image of higher quality by selecting the suitable gradation pattern matched with the image without performing conventional standardized processing independently of images.

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CLAIMS

[Claim(s)]
[Claim 1]
In said relation which asked for and asked for the relation between a luminance signal and the frequency of occurrence from the accumulation histogram of the luminance signal in the inputted video signal The 1st amendment parameter which amends the luminance signal in the shadow field of the 1st less than threshold, It asks at least for one side of the 2nd amendment parameter which amends the luminance signal in the highlights field of the 2nd more than threshold. The image processing system which chooses a gradation pattern and is characterized by amending said inputted video signal based on the selected gradation pattern out of the gradation pattern decided beforehand based on the amendment parameter for which it asked.
[Claim 2]
It is the image processing system according to claim 1 characterized by for said 1st threshold being within the limits of 25 - 45 level value, and said 2nd threshold being within the limits of a 210 - 230 level value when a luminance signal is expressed with the level value of 0 to 255.
[Claim 3]
The image processing system according to claim 1 or 2 characterized by making said selectable gradation pattern into nine pieces.
[Claim 4]
The image processing system according to claim 1 to 3 characterized by using the same gradation pattern about a series of frames judged that a scene change did not arise in said accumulation histogram.
[Claim 5]
Divide the luminance signal of the inputted video signal into odd number and the even number field, and it divides into two or more blocks in each field. Ask for distribution for the block of every, and the average for every field is made into the 1st sharpness characteristic quantity. An accumulation delta histogram is calculated covering a low pass filter over the luminance signal divided into the field. The absolute value of the difference of the accumulation delta histogram is made into the 2nd sharpness characteristic quantity. The image processing system which determines a sharpness amendment parameter from two sharpness characteristic quantity, and is characterized by amending said inputted video signal based on the determined sharpness amendment parameter.
[Claim 6]
The image processing system according to claim 5 characterized by determining a saturation amendment parameter from the frequency of the average value of the frequency in 10 to 40% of color difference level, or a certain color difference level of said within the limits to the color difference level from which it asks for an accumulation histogram from the color-difference signal of the inputted video signal, and saturation serves as max.
[Claim 7]
The frequency of said accumulation histogram is an image processing system according to claim 6 characterized by accumulating to the color difference level which expresses low saturation from the color difference level showing high saturation.
[Claim 8]
the difference of said 1st sharpness characteristic quantity in the frame of order -- the image processing system according to claim 5 to 7 characterized by judging that the scene change arose in inter-frame [the] when a value is larger than a threshold.
[Claim 9]
The image processing system according to claim 8 characterized by using the data which weight averaged to

time amount shaft orientations about a series of frames judged that a scene change did not arise in said accumulation histogram.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
About an image processing system, especially this invention relates to the image processing system which can process a video signal, in order to acquire an image for high definition.
[0002]
[Description of the Prior Art]
In recent years, a digital conversion-to-signals technique progresses and it has come to be used instead of the conventional analog image. There is little degradation by the external factor, and since the description of the digital image to an analog image can amend degradation of an analog image by the image processing, it is being able to acquire a still high definition image.
[0003]
Here, the gradation compensator adjusted to the automatically suitable image of gradation by processing a video signal is known (JP,6-95632,A). Moreover, the saturation compensator adjusted to the automatically suitable image of saturation by processing a video signal is known (JP,2000-224607,A). Furthermore, the sharpness compensator adjusted to the automatically suitable image of sharpness by processing a video signal is known (patent No. 2692531).
[0004]
[Problem(s) to be Solved by the Invention]
According to the conventional gradation compensator mentioned above, since it is asking for the amendment curve from a certain data of one frame in a video signal, a gradation amendment curve is changed for every frame, and there is a possibility that an unnatural image may be acquired by processing. Moreover, according to the conventional saturation compensator, the saturation correction factor is calculated from the average and maximum of saturation data using the extract means of a saturation component. However, the average and maximum of saturation data do not restrict visually that it is suitable as characteristic quantity of saturation, but there is a problem that saturation amendment cannot necessarily adjust the optimal. Furthermore, since processing in which extract an edge field and an edge component is normalized with edge area is performed according to the conventional sharpness compensator, there is a problem that processing becomes complicated.
[0005]
This invention aims at offering the image processing system which was made in order to solve such a conventional problem, performs natural gradation amendment automatically, and can perform saturation amendment and sharpness amendment by easy processing.
[0006]
[Means for Solving the Problem]
In said relation for which the image processing system of the 1st this invention asked for the relation between a luminance signal and the frequency of occurrence from the accumulation histogram of the luminance signal in the inputted video signal, and it asked The 1st amendment parameter which amends the luminance signal in the shadow field of the 1st less than threshold, It asks at least for one side of the 2nd amendment parameter which amends the luminance signal in the highlights field of the 2nd more than threshold. Since said inputted video signal is amended based on the gradation pattern which chose the gradation pattern and was chosen based on the amendment parameter for which it asked out of the gradation pattern decided beforehand (by for example, thing compared with a threshold) Like the former, processing which was not concerned with the image but was uniformalized is not performed, but a video signal can be

amended so that a high definition image can be acquired by choosing a suitable gradation pattern according to an image.
[0007]
Furthermore, said 1st threshold is within the limits of 25 - 45 level value, and when it is within the limits of a 210 - 230 level value, since said 2nd threshold can aim at coexistence of high-definition-izing by processing effectiveness and amendment, it is desirable, when a luminance signal is expressed with the level value of 0 to 255.
[0008]
In addition, when said selectable gradation pattern is made into nine pieces, it is desirable, but you may be the other number as long as it is plurality.
[0009]
Moreover, in said accumulation histogram, if the same gradation pattern is used about a series of frames judged that a scene change did not arise, since the inter-frame image quality change by amendment can be controlled, it is desirable.
[0010]
The image processing system of the 2nd this invention divides the luminance signal of the inputted video signal into odd number and the even number field. Divide into two or more blocks in each field, and it asks for distribution for the block of every. An accumulation delta histogram is calculated making the average for every field into the 1st sharpness characteristic quantity, and covering a low pass filter over the luminance signal divided into the field. The absolute value of the difference of the accumulation delta histogram is made into the 2nd sharpness characteristic quantity. Determine a sharpness amendment parameter from two sharpness characteristic quantity, and since said inputted video signal is amended based on the determined sharpness amendment parameter Sharpness amendment can be performed by using a statistical procedure, without performing processing in which extract an edge field one by one and an edge component is normalized with edge area like the conventional technique.
[0011]
Furthermore, it is desirable when a saturation amendment parameter is determined to the color difference level from which it asks for an accumulation histogram from the color-difference signal of the inputted video signal, and saturation serves as max from the frequency of the average value of the frequency in 10 to 40% of color difference level, or a certain color difference level of said within the limits. As color difference level, when an accumulation histogram is expressed with -128 (-127) to +127 (+128), it is desirable in one being -13 or less [-51 or more], and another being 51 or less [13 or more].
[0012]
Moreover, when the frequency of said accumulation histogram is accumulated to the color difference level which expresses low saturation from the color difference level showing high saturation, it is desirable.
[0013]
furthermore, the difference of said 1st sharpness characteristic quantity in the frame of order -- when a value is larger than a threshold and it judges that the scene change arose in inter-frame [the], it is before and after a scene change, and since processing is changeable, it is desirable.
[0014]
Moreover, in said accumulation histogram, if the data which weight averaged to time amount shaft orientations are used about a series of frames judged that a scene change did not arise, since more suitable processing can be performed using the data of the frame of the back before there is no effect of a scene change, it is desirable.
[0015]
[Embodiment of the Invention]
The gestalt of operation of this invention is explained referring to a drawing. Drawing 1 is the block diagram of the automatic image purge which is an example of the image processing system of this invention. This automatic image purge is an outputting [the video signal which can acquire a high definition image by performing predetermined processing]-to input video signal thing.
[0016]
The input signal Yin which constitutes an input video signal, Cbin, and Crin change into a digital signal the analog composite signal inputted from a non-illustrated videocassette recorder etc. with a non-illustrated A/D converter. This input signal is inputted into the characteristic quantity count section 102 for extracting the characteristic quantity of an image while it is accumulated in a frame buffer 101. In the characteristic quantity count section 102, based on an input signal, the parameter for an image quality improvement is

outputted from the characteristic quantity of an image, and it is inputted into the image-processing section 103. In the image-processing section 103, sharpness amendment, gradation amendment, and saturation amendment are performed based on this parameter. Since a part for the computation time of characteristic quantity is delayed, a frame buffer 104 is formed, and an image quality improvement parameter and the video signal which was able to take the synchronization are inputted into the image-processing section 103. After the output signals Yout, Cbout, and Crout from the image-processing section 103 are changed into an analog composite signal by the non-illustrated D/A converter, they are inputted into a non-illustrated television monitor etc.

[0017]

Next, each contents of processing are explained in detail about the characteristic quantity count section 102 and the image-processing section 103. Here, an input signal is made into 8 bits and the example for which one frame processes the image of 720x480 is shown. The characteristic quantity count section 102 consists of sharpness count section 102a, block distribution count section 102b, Y-accumulation histogram count section 102c, Cb, 102d of Cr-accumulation histogram count sections and scene change detecting-element 102e, and 102g of gradation amendment curve generation sections and 102h of saturation correction factor generation sections. [102f of sharpness correction factor generation sections, and]

[0018]

Block distribution count section 102b divides the image of one frame into odd number and the even number field, as shown in drawing 7 , and it divides it for every 64x64-pixel block in each field. And distribution is calculated within each block and the variance of the field is averaged by the block count in a frame. Although this block size is not scrupulous, 8x8 or more are desirable. Moreover, the length of a block may differ from the horizontal number of pixels. The block variance (1st sharpness characteristic quantity) as a result is outputted to 102f of sharpness correction factor generation sections, and scene change detecting-element 102e.

[0019]

In scene change detecting-element 102e, the variance for every field outputted from block distribution count section 102b is averaged, and the block variance of a frame is calculated. the block variances a (t-1)-a (t+3) shown in drawing 8 which set this to a (t) and set the time-axis as the axis of abscissa -- using -- a formula (A1) and the difference of (A2) -- a value is calculated and a scene change (the scene of an image changed) is detected by the conditional expression of a formula (A3). Moreover, not using the block variance of a frame, you may judge considering a (t) as a variance of the field.

$$Diff0 = |a(t) - a(t+1)| \quad \cdots (A1)$$

$$Diff1 = (|a(t-1) - a(t)| + |a(t+2) - a(t+3)|)/2 \quad \cdots (A2)$$

if (Diff0>Tcs1) then [シーンチェンジあり]、
else if (Diff0>Tcs2
and Diff0/Diff1>Tcs3) then
[シーンチェンジあり]、
else then シーンチェンジなし
(ただし、各閾値はTcs1>Tcs2>Tcs3である) ・・・(A3)

[0020]

In sharpness count section 102a, a luminance signal is divided into the odd number field and the even number field, and it asks for a delta histogram in each field. The count approach of a delta histogram is shown. First, a dotage image is made, covering the spatial filter (low pass filter) which a luminance signal carries out each field pair, for example, has the multiplier of a formula (2).

0.0625 0.125 0.0625
0.125 0.25 0.125 ... (2)
0.0625 0.125 0.0625

[0021]
furthermore, a pixel with each field -- receiving -- 8 pixels [of perimeters] difference -- a value is made into a histogram. This is performed by all the pixels in the field, and it asks for a delta histogram. Next, accumulation even of the brightness difference level 0-255 of a delta histogram is carried out, and it asks for an accumulation delta histogram. This is similarly performed to an input luminance signal. The accumulation histogram of D (i) and a dotage image is set to Dl (i) for the accumulation delta histogram of an input luminance signal, and the absolute value of the difference of an accumulation histogram is averaged on brightness difference level like a formula (3), and let this be the amount S of sharpness.
[Equation 1]

$$S = \frac{1}{256}\sum_{i=0}^{255}\left|D(i) - D_l(i)\right| \quad \cdots (3)$$

[0022]
The amount S of sharpness is calculated from odd number and the even number field, and let the average be the sharpness value (2nd sharpness characteristic quantity) of a frame. In 102f of sharpness correction factor generation sections, the sharpness correction factor (sharpness amendment parameter) alpha is derived by the sharpness value and the block variance. For example, the amount S of sharpness is distinguished with thresholds Ts0-Ts4, and the sharpness correction factor alpha within a certain level is determined. Furthermore, the block variance for every field is averaged, the block variance Vi of a frame is calculated, and Vi is distinguished with a threshold Tvar, and when a block variance is larger than Tvar, it controls to enlarge alpha. Moreover, when Vi is below Tvar, it controls to make alpha small. If an example is shown, it will become like following (4) and (5) types. However, the value of alpha is not restricted to below.
[0023]

if (シャープネス量S>T_{s0}) then α=1.0
else if (T_{s1}<シャープネス量S≦T_{s0}) then α=1.2
else if (T_{s2}<シャープネス量S≦T_{s1}) then α=1.4
else if (T_{s3}<シャープネス量S≦T_{s2}) then α=1.6
else if (T_{s4}<シャープネス量S≦T_{s3}) then α=1.8
else then α=1.5
・・・(4)

if (V>T_{var}) then $\alpha=\alpha+V_i/T_{var}$
else $\alpha=\alpha-(V_i-T_{var})/T_{var}$
・・・(5)

[0024]
Drawing 2 is drawing showing the example (a) of a histogram and the example (b) of an accumulation histogram based on an input signal. Here, Y-accumulation histogram count section 102c asks for the histogram of brightness Y like drawing 2 (a), and performs accumulation from 0 to 255. And it normalizes at the maximum of cumulative frequency (refer to drawing 2 (b)). Here, the maximum of cumulative frequency is normalized to 100.
[0025]
Since the data of a front frame can be used for the improvement in image quality when a scene change is not detected next, it weight averages with the accumulation histogram of a front frame. The accumulation histogram of cfdYi [j] and a front frame is calculated by the following (6) types in it, using the accumulation histogram of the present frame as cfdYi-1[j]. Since a gradation property does not change a lot for every frame by equalizing an accumulation histogram in the direction of a time-axis, an image can change

smoothly. In addition, since a front frame cannot be used when a scene change is detected, the accumulation histogram cfdYi of the present frame [j] is used as it is.
[0026]

$$cfdY_i[j] = (1.0-\gamma_0)\cdot cfdY_{i-1}[j] + \gamma_0\cdot cfdY_i[j] \quad (j=0,1,\cdots,255)$$

ただし、$0.0 \leq \gamma_0 \leq 1.0$ ・・・(6)

[0027]
In the accumulation histogram shown in drawing 2 (b), in the section (shadow field) of intensity-level A, and the section (highlights field) of intensity-level B and an intensity level 255, 102g of gradation amendment curve generation sections asks for the difference (part shown by hatching) of a property with linear cumulative frequency, and an accumulation histogram, and they calculate the average by intensity-level width of face from an intensity level 0. The level value of B which the level value of A which is the 1st threshold is 35 preferably 45 or less [25 or more] here, and is the 2nd threshold is 220 preferably 230 or less [210 or more].
[0028]
Next, they are Da (the 1st amendment parameter) and Db (it considers as the 2nd amendment parameter and one pattern is chosen from nine gradation amendment curves shown in (i) from drawing 3 (a) from the relation of these averages Da and Db and a certain threshold.) about the average of difference, respectively. In addition, drawing 3 may show the example of a pattern to the last, and a pattern may be not only except these but except nine pieces.
[0029]
Here, the threshold over Da is set to Ta, the threshold over Db is set to Tb, and the conditional expression of a formula (7) determines the pattern of a gradation amendment curve.

if $(D_b<-T_b)$ then:
  if $(D_a>T_a)$ then 階調補正カーブ=パターン(b)
  else if $(D_a<-T_a)$ then 階調補正カーブ=パターン(e)
  else then 階調補正カーブ=パターン(d)
else if $(D_b>T_b)$ then:
  if $(D_a>T_a)$ then 階調補正カーブ=パターン(h)
  else if $(D_a<-T_a)$ then 階調補正カーブ=パターン(c)
  else then 階調補正カーブ=パターン(g)
else then:
  if $(D_a>T_a)$ then 階調補正カーブ=パターン(i)
  else if $(D_a<-T_a)$ then 階調補正カーブ=パターン(f)
  else then 階調補正カーブ=パターン(a)
・・・(7)

[0030]
Moreover, in the frame with which a scene change is not detected, in case the above-mentioned pattern changes, as shown in a formula (8), gradation amendment curve Luti-1 of the gradation amendment curve Luti of the present frame and a front frame is weight averaged. The abrupt change of a gradation amendment curve can be stopped by such processing.
[0031]
Luti[j] = (1.0-gamma1), Luti-1[j]+gamma1, and Luti [j] (j= 0, 1, ..., 255)
However, 0.0 <=gamma1 <=1.0 ... (8)
Moreover, it is also possible to process using the same pattern, without only the frame with which the scene change was detected changing a gradation pattern, and changing a gradation pattern on the other scene (inside of the same scene).
[0032]
Drawing 4 (a) is drawing showing a color difference histogram, and drawing 4 (b) is drawing showing a color difference accumulation histogram. In Cb and 102d of Cr-accumulation histogram count sections, in the color difference histogram of drawing 4 (a), accumulation is performed by dividing into two, the section from the color difference level -128 to -2, and the sections from 127 to two, and it normalizes at the maximum of cumulative frequency. The result is shown in drawing 4 (b).
[0033]
Here, it is normalizing to 100. As shown in the following (9) and (10) types, accumulation histogram cfdCbi-1[j] cfdCri-1[j] of a front frame and the accumulation histograms cfdCbi [j] and cfdCri of the present frame [j] are weight averaged.
cfdCbi[j] = (1.0-gamma2) and cfdCbi-1[j]
+ gamma2 and cfdCbi [j]
(j= 0, 1, ..., 255)
However, 0.0 <=gamma2 <=1.0 ... (9)
cfdCri[j] = (1.0-gamma3) and cfdCri-1[j]
+ gamma3 and cfdCri [j]
(j= 0, 1, ..., 255)
However, 0.0 <=gamma3 <=1.0 ... (10)
[0034]
Here, in cfdCbi [0] and cfdCri [0], the cumulative frequency of the color difference level -128, cfdCbi [255], and cfdCri [255] express the cumulative frequency of the color difference level 127.
[0035]
102h of saturation correction factor generation sections asks for the largest frequency in the accumulation histogram of drawing 4 (b) the cumulative frequency cfdCbi [SL0], cfdCri [SL0], and cfdCbi of the color difference level SL0 and SL1 [SL1], and among cfdCri(s) [SL1]. Here, as for color difference level, it is desirable to be referred to as -51 <=SL0 <=-13 and 13 <=SL 1<=51. In drawing 4 (b), B becomes the maximum frequency. The frequency of this B is set to Sat and the threshold over Sat is calculated for the saturation correction factor beta (Sat can be expressed with the predetermined function f (Sat) made into the variable) from the following (11) types as Tsat0, Tsat1, and Tsat2.
if (Sat<=Tsat0) then beta=(Tsat0-Sat) -a
else if (Tsat1<sat<=Tsat2)
then beta=(Sat-Tsat1) -b
else if(Sat>Tsat2)
then beta= (Sat-Tsat2) and c-d
else then beta=0.0
... (11)
[0036]
Here, a, b, c, and d are the constants for computing beta. Moreover, it is also possible to hold on non-illustrated memory by making into a look-up table the value outputted by (11) formulas.
[0037]
Next, the image-processing section 103 is explained. The image-processing section 103 has motion vector detecting-element (MV)103a, noise reducer (NR)103b, noise smoother (NS)103c, 103d of gradation amendment sections and sharpness amendment section 103e, and 103f of saturation amendment sections.
[0038]

Motion vector detecting element (MV) In 103a, one frame is divided into the odd number field and the even number field, and each block which divided each field into two or more blocks performs block matching. This detects how the photographic subject moved on the screen.
[0039]
Each block of the present frame shown in drawing 5 is moved vertically and horizontally in the odd number field and the even number field of a front frame or a back frame, and let the direction where total of difference with the block of the present frame becomes min be a motion vector in a block (m, n). If 1 block is made into 16x16 pixels, the block in 1 field will be set to (0, 0) to (43, 13). Here, as shown in drawing 5 , the edge for 8 pixels is attached to the four directions of a field image. It is expressed with the following (12) and (13) types, when total of the difference of each block is divided into each field and set to dY[0] mn and dY[1] mn.
[Equation 2]

$$dY[0]_{mn} = \sum_{j=0}^{1}\sum_{vy=-32}^{31}\sum_{vx=-32}^{31}\sum_{k=0}^{15}\sum_{l=0}^{15}\left|Y_l[i][0](x'_{mn}+l, y'_{mn}+k) - Y_l[i+1][j](x'_{mn}+vx+l, y'_{mn}+vy+k)\right| \quad \cdots (12)$$

[Equation 3]

$$dY[1]_{mn} = \sum_{j=0}^{1}\sum_{vy=-32}^{31}\sum_{vx=-32}^{31}\sum_{k=0}^{15}\sum_{l=0}^{15}\left|Y_l[i][1](x'_{mn}+l, y'_{mn}+k) - Y_l[i+1][j](x'_{mn}+vx+l, y'_{mn}+vy+k)\right| \quad \cdots (13)$$

[0040]
Here, Yl [i] and [0] (x y) express the luminance signal of the coordinate (x y) in the even number field of the i-th frame. Moreover, Yl [i] and [1] (x y) express the luminance signal in the odd number field. x'mn and y'mn express the coordinate of the upper left pixel within a block (m, n).
[0041]
From (12) and (13) types, total of difference calculates j, vx, and vy used as min, and sets the motion vector in the block (m, n) of each field to (vx[0] mn, vy[0] mn), and (vx[1] mn, vy[1] mn).
[0042]
Here, when a scene change is detected, block matching is performed with the present frame and a back frame, and block matching is performed with the present frame and a front frame except a scene change.
[0043]
Next, the motion vector for which it asked is used and total dC[0] mn of the difference of each block in a color-difference signal and dC[1] mn are calculated. This is expressed with the following (14) and (15) types.
[Equation 4]

$$dC[0]_{mn} = \sum_{k=0}^{15}\sum_{l=0}^{15}\left|C[i][0](x'_{mn}+l, y'_{mn}+k) - C[i+1][j](x'_{mn}+vx[0]_{mn}+l, y'_{mn}+vy[0]_{mn}+k)\right| \quad \cdots (14)$$

[Equation 5]

$$dC[1]_{mn} = \sum_{k=0}^{15}\sum_{l=0}^{15}\left|C[i][0](x'_{mn}+l, y'_{mn}+k) - C[i+1][j](x'_{mn}+vx[1]_{mn}+l, y'_{mn}+vy[1]_{mn}+k)\right| \quad \cdots (15)$$

[0044]
Here, C [i], [0] (x y), and C [i] and [1] (x y) express the color-difference signal of the coordinate (x y) of the i-th frame. This is performed about color-difference signals Cb and Cr, and total of difference sets a large value to dC[0] mn and dC[1] mn.
[0045]
Next, total of the difference for which it asked by (12) - (15) formula is used, and feedback multiplier rho[0] mn used by noise reducer (NR)103c and rho[1] mn are determined. Here, thresholds Tyd and Tcd determine a feedback multiplier from the following (16) and (17) types.

if (dY[0]mn,<Tyd and dC[0]mn<Tcd)
then rho [0] mn=tau
else then rho[0] mn=0.0
... (16)
To this appearance
if (dY[1]mn,<Tyd and dC[1]mn<Tcd)
then rho [1] mn=tau
else then rho[1] mn=0.0
... (17)
[0046]
Here, relation of two thresholds is made into Tcd<Tyd and, as for tau, it is desirable to be referred to as 0.3<=tau<=0.6. Then, a motion vector (vx [0] mn, vy[0] mn) and (vx [1] mn, vy[1] mn) feedback multiplier rho[0] mn, and rho[1] mn are inputted into noise RYUDEYUSA (NR)103c.
[0047]
Noise reducer (NR)103c weight averages with the pixel value of a front frame or a back frame using the motion vector and feedback multiplier for which it asked by motion vector detecting-element (MV)103a. With a scene change frame, the following (18) and (19) types average with the pixel of the odd number of a back frame, or the even number field.
[Equation 6]

$$Y[i][0](x,y) = (1.0 - \rho[0]_{mn}) \cdot Y[i][0](x,y) - \rho[0]_{mn} \cdot Y[i+1][j](x + vx[0]_{mn}, y + vy[0]_{mn}) \quad \cdots (18)$$

[Equation 7]

$$Y[i][1](x,y) = (1.0 - \rho[1]_{mn}) \cdot Y[i][1](x,y) - \rho[1]_{mn} \cdot Y[i+1][j](x + vx[1]_{mn}, y + vy[1]_{mn}) \quad \cdots (19)$$

[0048]
Except a scene change frame, it averages with the pixel of the odd number of a front frame, or the even number field. And (18), pixel value Y [i] which weight averaged by (19) types and [0] (x y), and Y [i] and [1] (x y) are inputted into sharpness count section 103e as luminance-signal Y'.
[0049]
In Cb and Cr image which divided one frame into odd number and the even number field, noise smoother (NS)103c averages the signal in a certain image field centering on a certain coordinate (x y), and makes the average the pixel value in (x, y). Here, as shown in drawing 6 , let the field of equalization be the square field of 17x17. However, it is good also as not the thing to restrict to this but a field where the numbers of pixels of length and width differ.
[0050]
In 103d of gradation amendment sections, the following (20) types perform gradation amendment by the look-up table Luti outputted from the gradation amendment curve generation section.
Y'l = Luti [Yl] ... (20)
[0051]
In sharpness amendment section 103e, from output Y' of output Y'l of the dotage image Yl and the gradation amendment section, and noise reducer (NR)103b calculated by sharpness count section 102a, it calculates according to the following (21) types, and sharpness amendment is performed. Yout = Y'l+alpha- (Y'-Yl) ... (21)
[0052]
103f of saturation amendment sections calculates (22) types with the parameter beta inputted from 102h of saturation correction factor generation sections.
Cbout = Cb'xbeta
Crout = Cr'xbeta
... (22)
[0053]
The signal containing Yout, Cbout, and Crout is outputted from an automatic image purge by the above

processing, and the video signal which performed gradation, saturation, and sharpness amendment automatically can be acquired. In addition, this invention is realizable with software besides the configuration by hardware.

[0054]

As mentioned above, although this invention has been explained with reference to the gestalt of operation, this invention is limited to the gestalt of the above-mentioned implementation, and should not be interpreted, but, of course, modification and amelioration are possible suitably.

[0055]

[Effect of the Invention]

According to this invention, the image processing system which performs natural gradation amendment automatically and can perform saturation amendment and sharpness amendment by easy processing can be offered.

[Brief Description of the Drawings]

[Drawing 1]

It is the block diagram of the automatic image purge which is an example of an image processing system.

[Drawing 2]

It is drawing showing the example (a) of a histogram and the example (b) of an accumulation histogram based on an input signal.

[Drawing 3]

It is drawing showing the example of a pattern of a gradation amendment curve.

[Drawing 4]

Drawing 4 (a) is drawing showing a color difference histogram, and drawing 4 (b) is drawing showing a color difference accumulation histogram.

[Drawing 5]

It is drawing showing the frame by which the block division was carried out.

[Drawing 6]

the difference of central value and each pixel value in a field -- it is drawing showing the result of having compared the value with the threshold TNS.

[Drawing 7]

It is drawing showing the relation between the field and a block.

[Drawing 8]

It is drawing showing the relation between a block variance and a scene change.

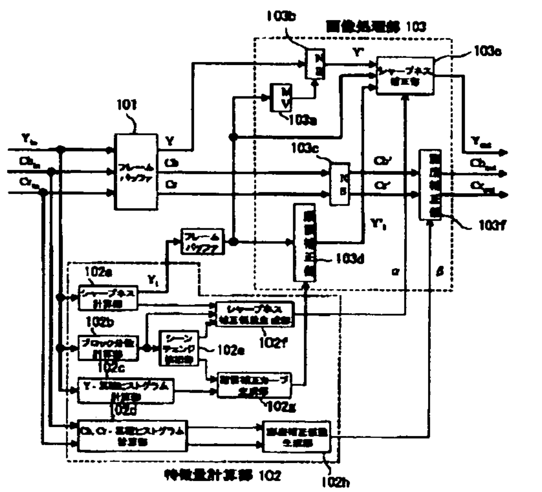
[Description of Notations]

101 Frame Buffer
102 Characteristic Quantity Count Section
103 Image-Processing Section

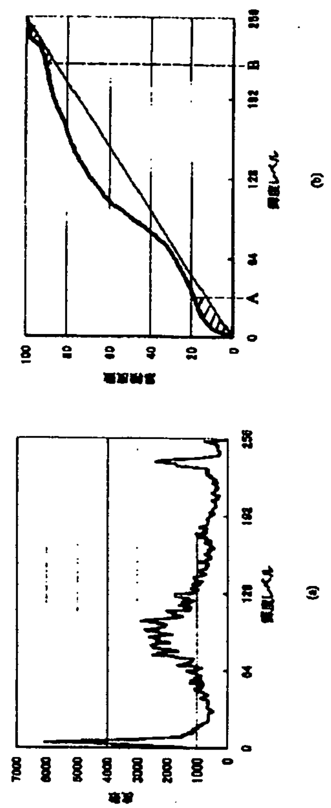
[Translation done.]

DRAWINGS

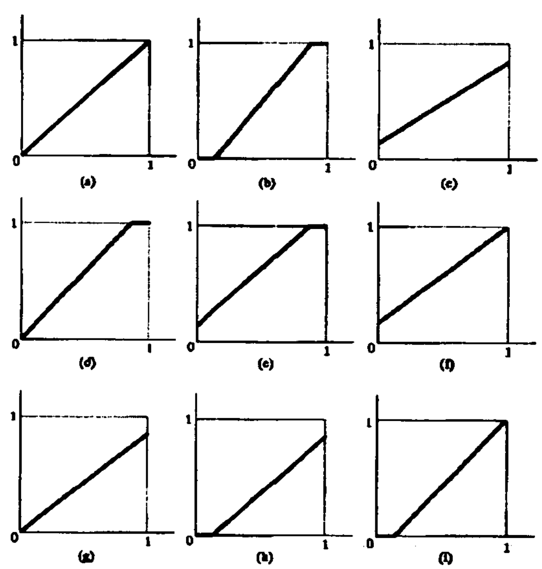
[Drawing 1]



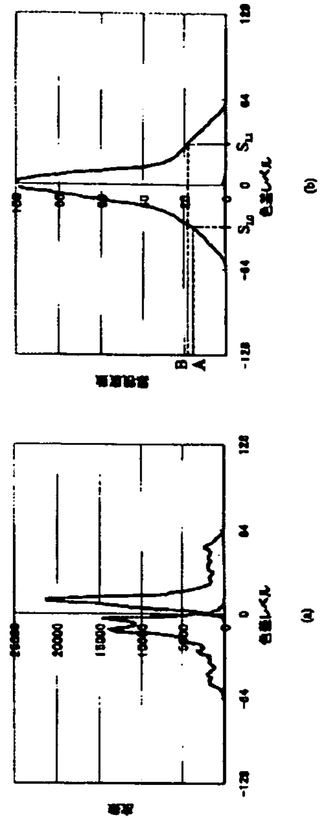
[Drawing 2]



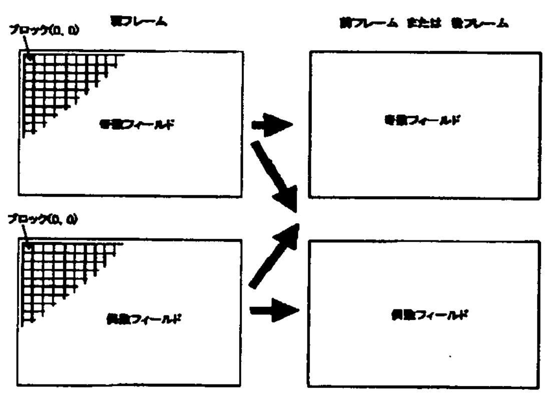
[Drawing 3]



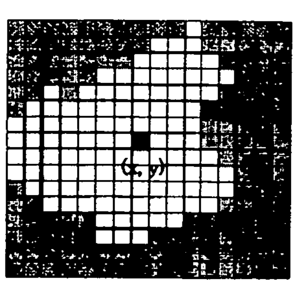
[Drawing 4]



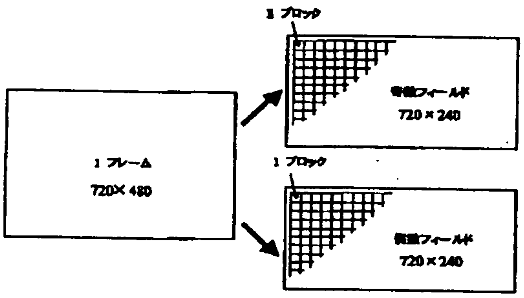
[Drawing 5]



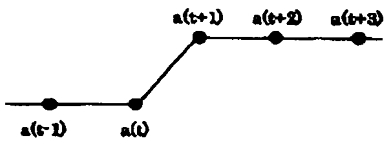
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]